

Indian Prairie Basin Surface Water Availability Approach

South Florida Water Management District
Water Resources Advisory Commission Meeting
November 3, 2016

Akintunde O. Owosina, P.E.
Chief, Hydrology and Hydraulics Bureau

Prior to the Water Rights Compact

- **Florida Water Resources Act of 1972 established a state permit system in lieu of the previous riparian system**
- **The Act did not take into account the Seminole Tribe of Florida's federal water rights**
- **Tribe sued the state for water rights in 1978**
- **Tribe, State, & District settled the litigation which provides in part for the Water Rights Compact**
- **Ratified by the U.S. Congress & Florida Legislature. Given the force and effect of both federal & state law**

Water Rights Compact

- **Formalized the process for District input into the Tribe's management of water in a manner that respects the Tribe's sovereignty**
- **Creates system of regulation applicable to Tribe's Reservation & trust lands that protects the Tribe's water rights & is consistent with the essential terms & principles of Florida water law**
- **Establishes water rights entitlements for the Big Cypress and Brighton Reservations**

Brighton Reservation Surface Water Entitlement

- **Compact entitles the Tribe to 15% of surface waters from the Indian Prairie Basin from specified canals**
- **Tribe entitled to fractional share of surface waters from Lake Okeechobee proportionate to the Reservation lands within the Lakeshore Perimeter Basin**
- **SFWMD maintains water levels in the C-40 and C-41 canals to deliver Brighton entitlement**
- **Sufficient volume of Lake Okeechobee water to be reserved & set aside to satisfy Brighton entitlement during water shortage**

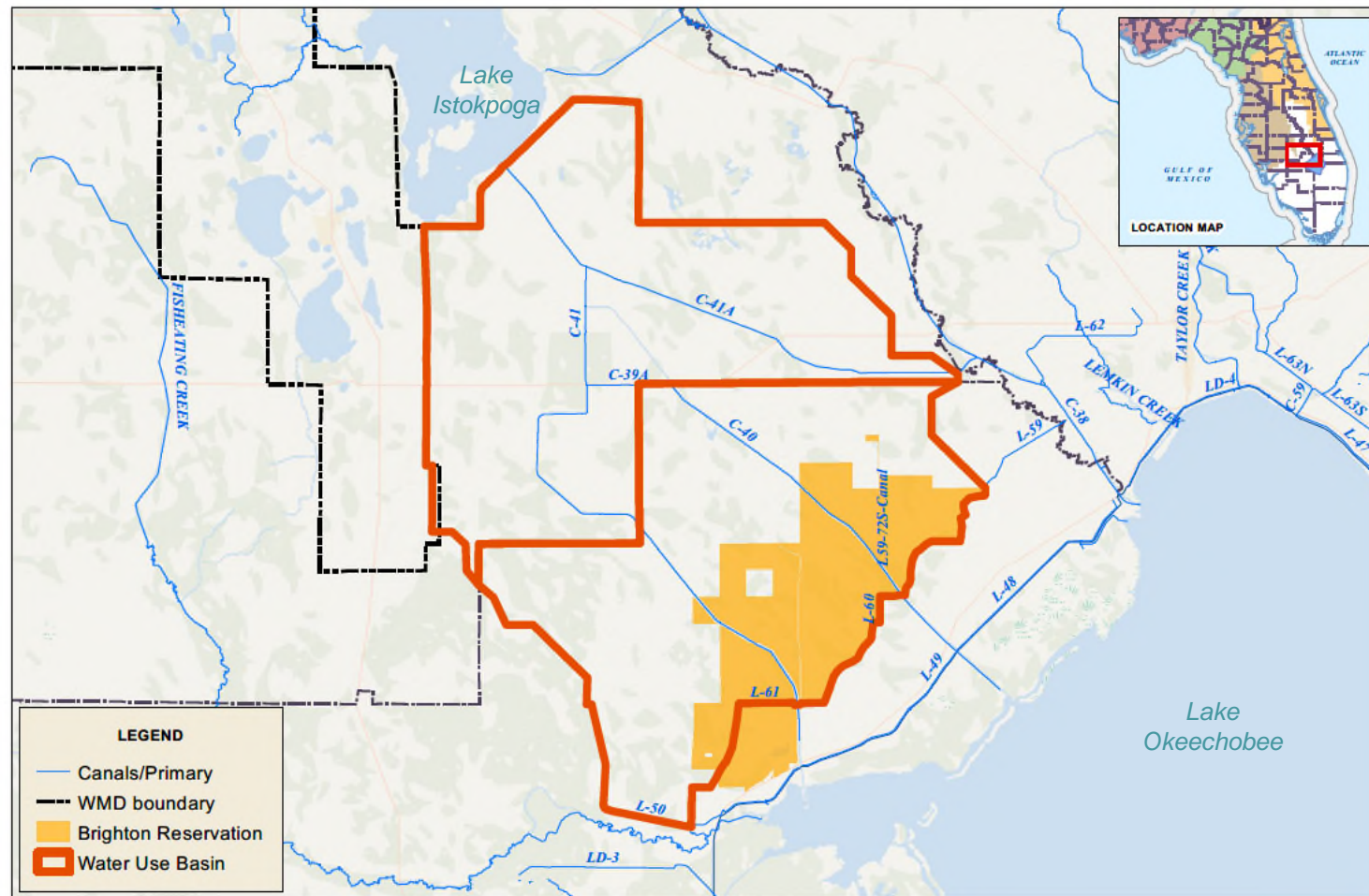
Brighton Reservation Surface Water Entitlement

- **1988 Technical Report attempted to quantify Brighton's surface water entitlement, fulfilling one of the District's obligations under the Compact**
- **District agreed to take another look at the quantification of the entitlement**
- **Before the entitlement can be quantified, must:**
 - **Identify the total amount of water in District canals and borrow canals**
 - **Identify the volume of water that can be withdrawn by all surface water users**

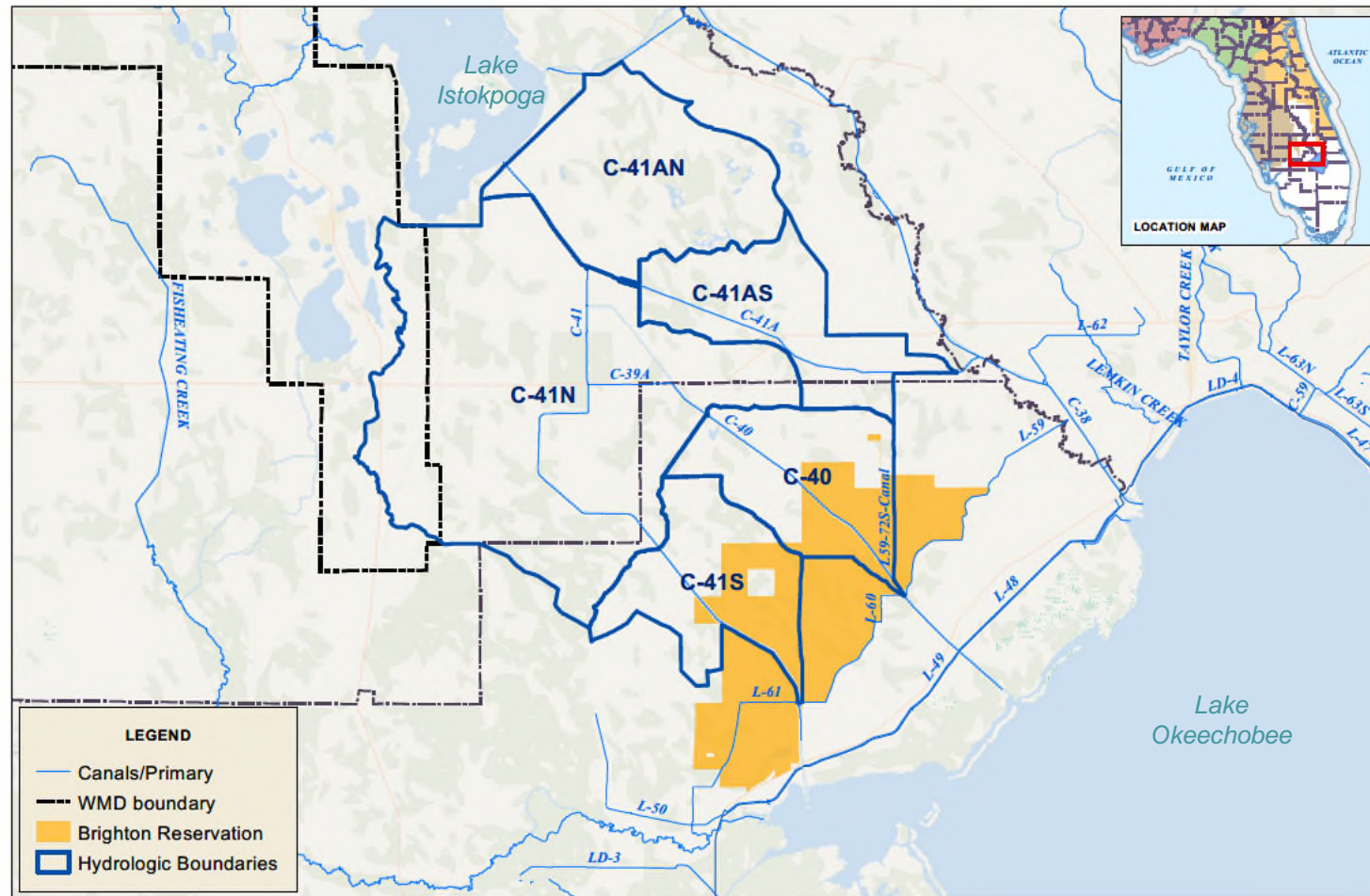
Purpose of Presentation

- **Discuss the SFWMD approach to quantify the total amount of surface water in the District's canals & borrow canals in the Indian Prairie Basin**
- **Describe the tool developed by SFWMD to quantify monthly volumes of the components of the historical water budget for the Indian Prairie Basin canal system**

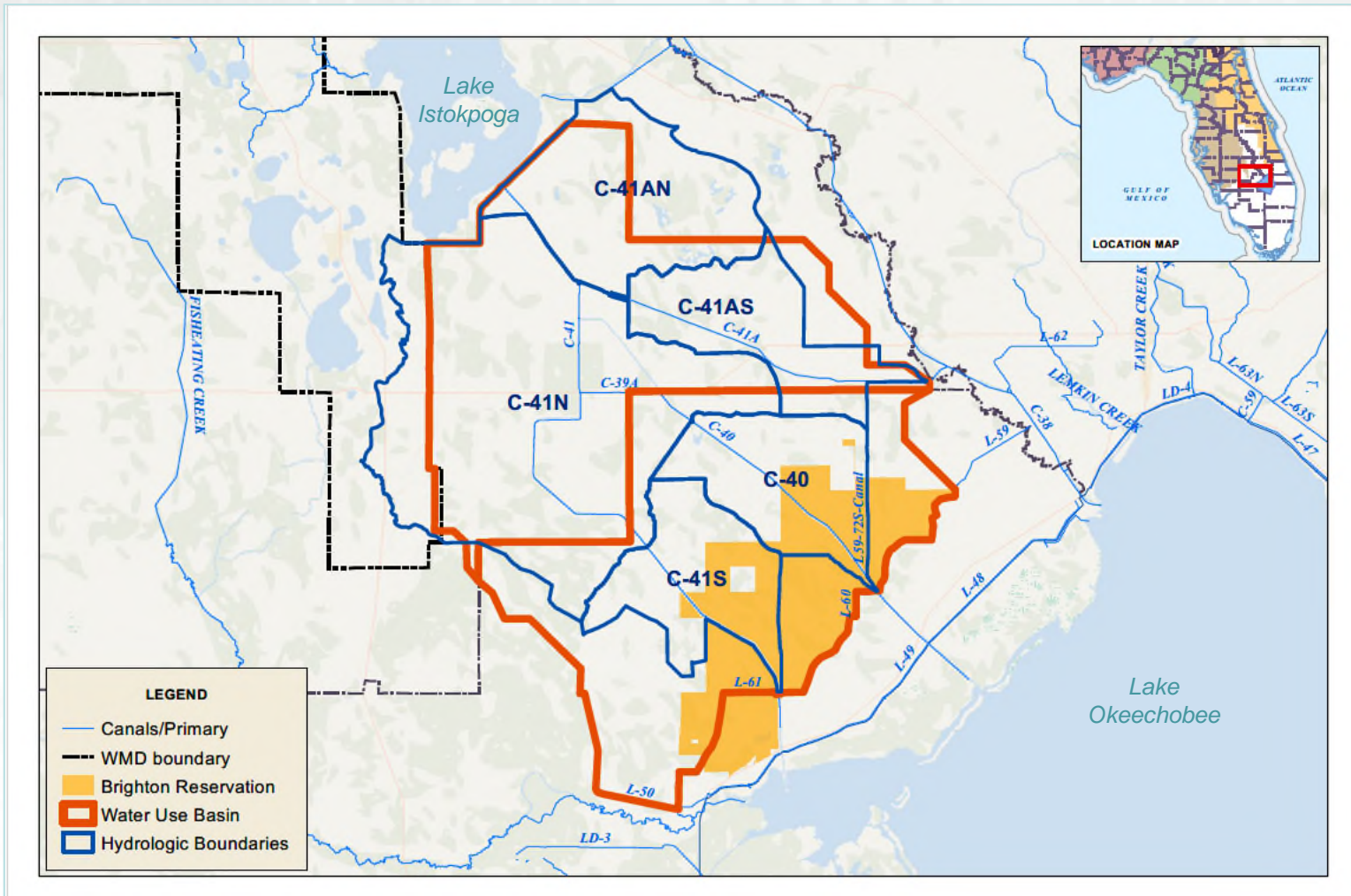
Water Use Basin

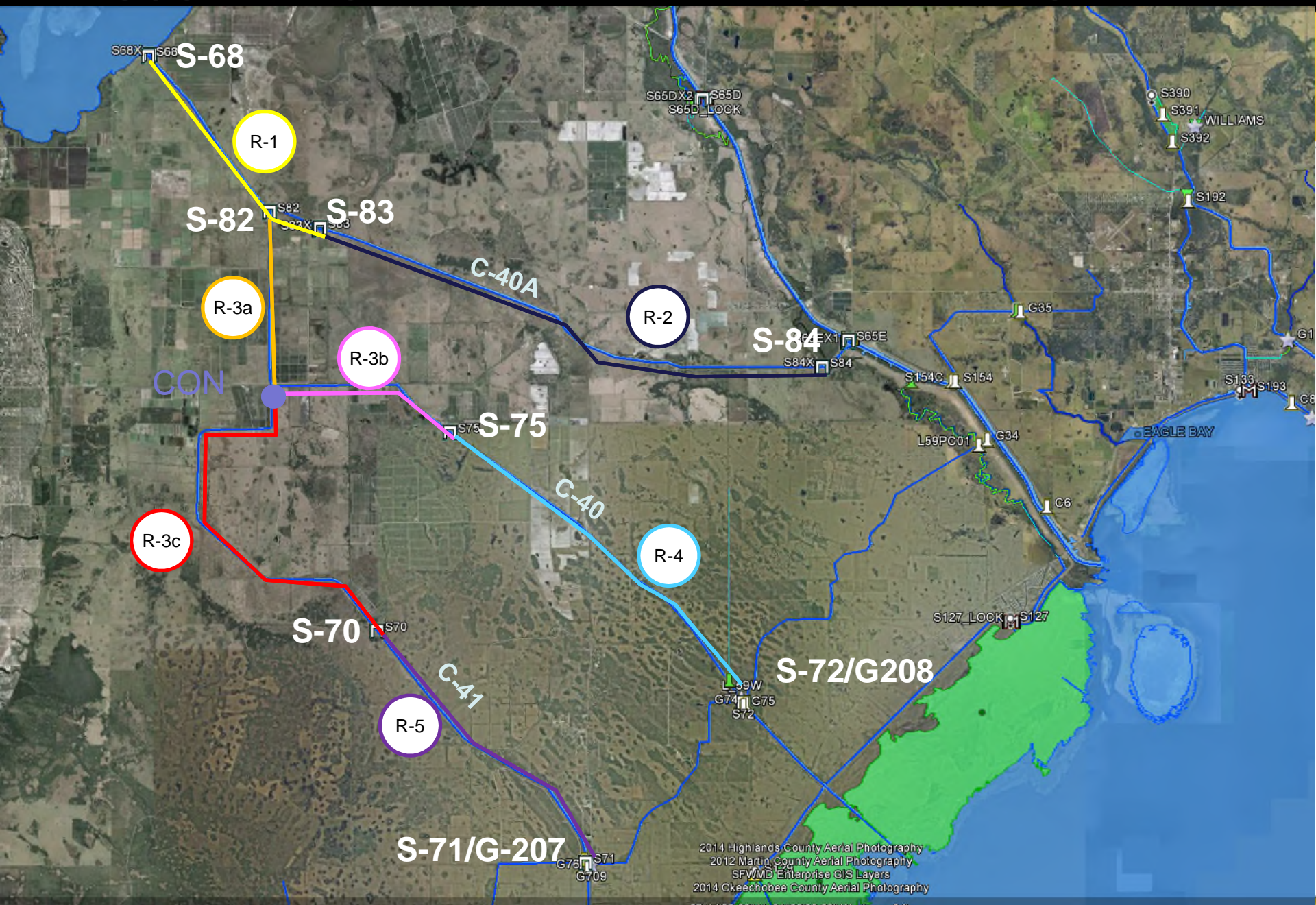


Hydrologic Watersheds



Hydrologic Watersheds and Water Use Basin





2014 Highlands County Aerial Photography
 2012 Martin County Aerial Photography
 SFWMD Enterprise GIS Layers
 2014 Okeechobee County Aerial Photography

What is a Water Budget ?

What is a
Water
Budget?

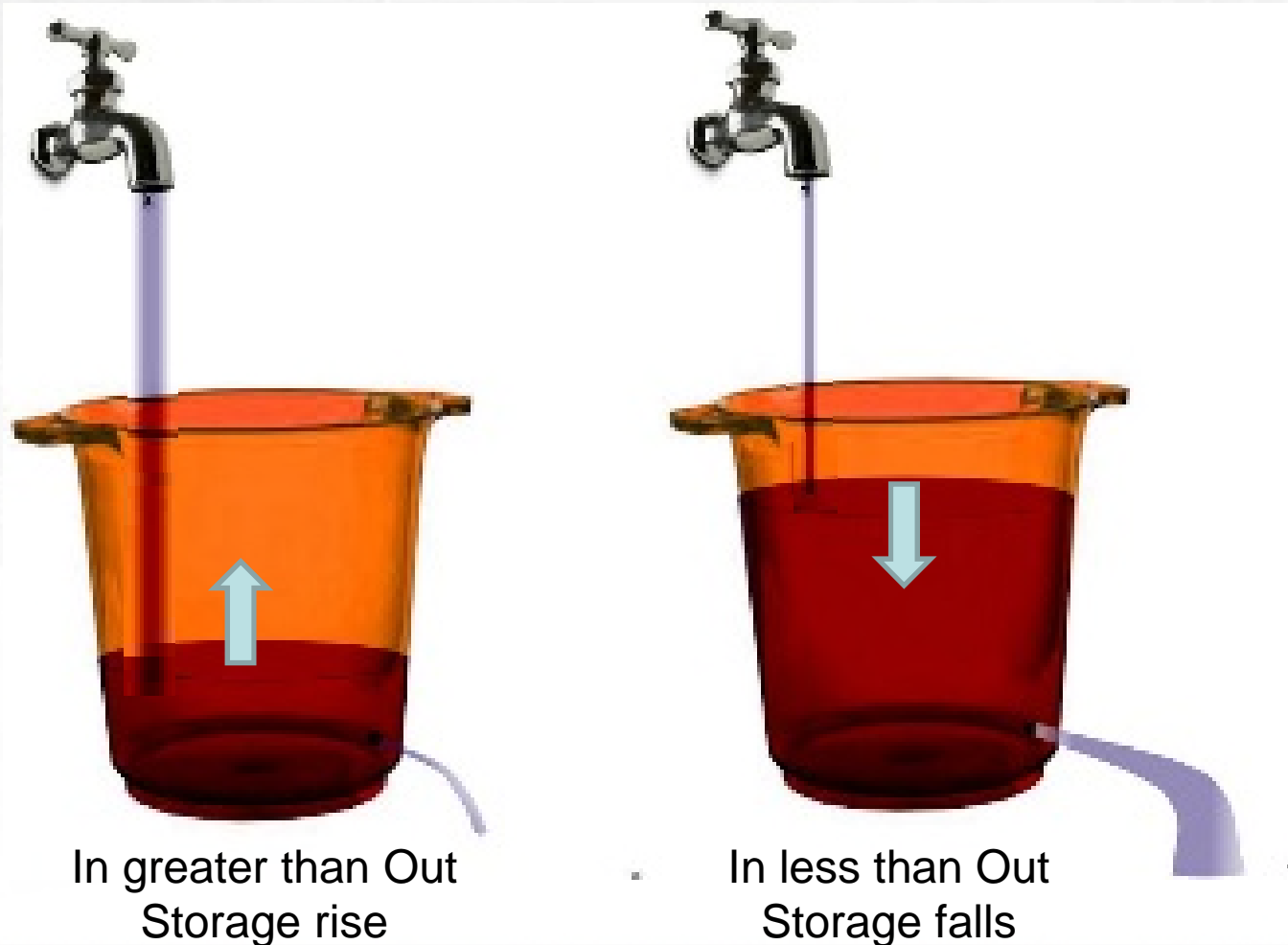


The water budget is the balance of the water that enters a closed system, such as rainfall and runoff, and the water that leaves, such as ET and consumption

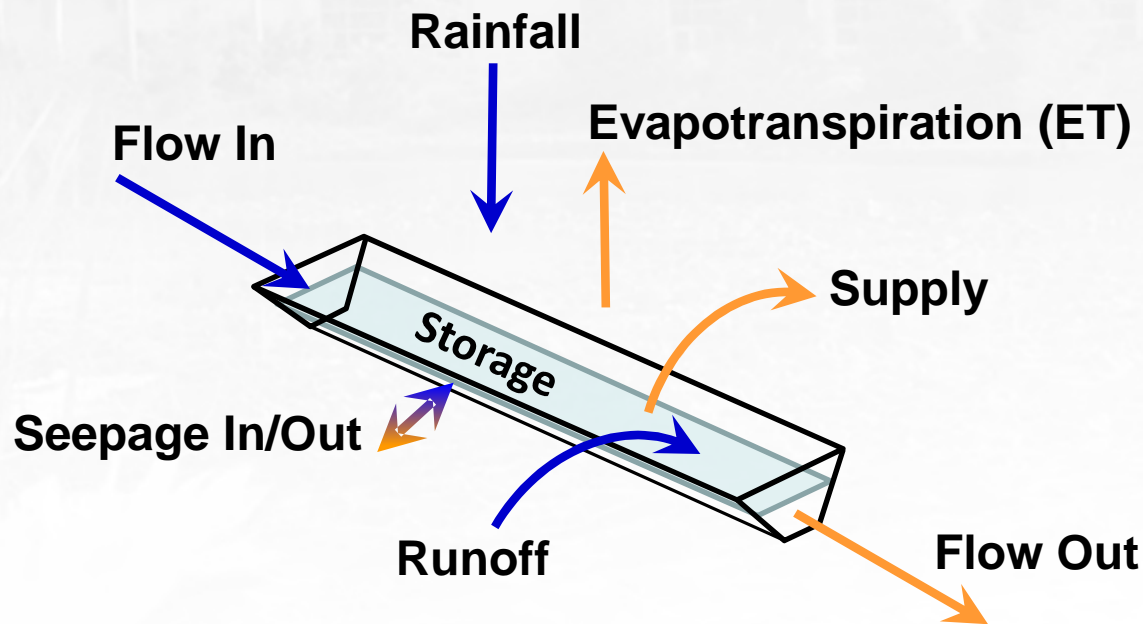
Regional District of Nanaimo, Canada

Filling a bucket analogy

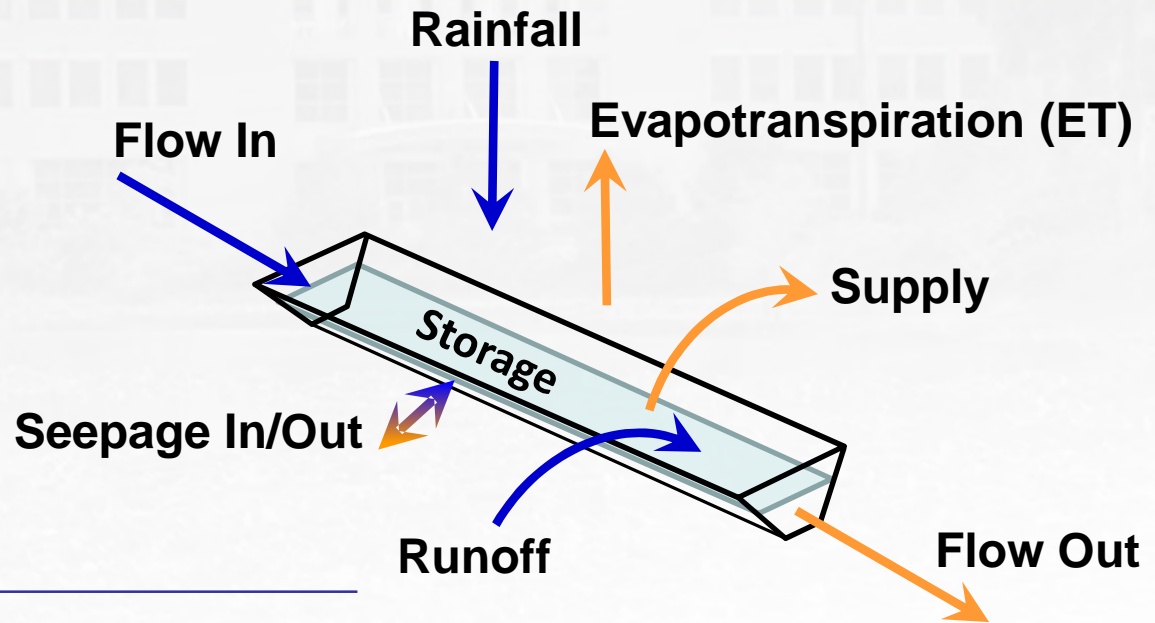
$$\text{Storage Change} = \text{IN} - \text{OUT}$$



Canal Water Budget



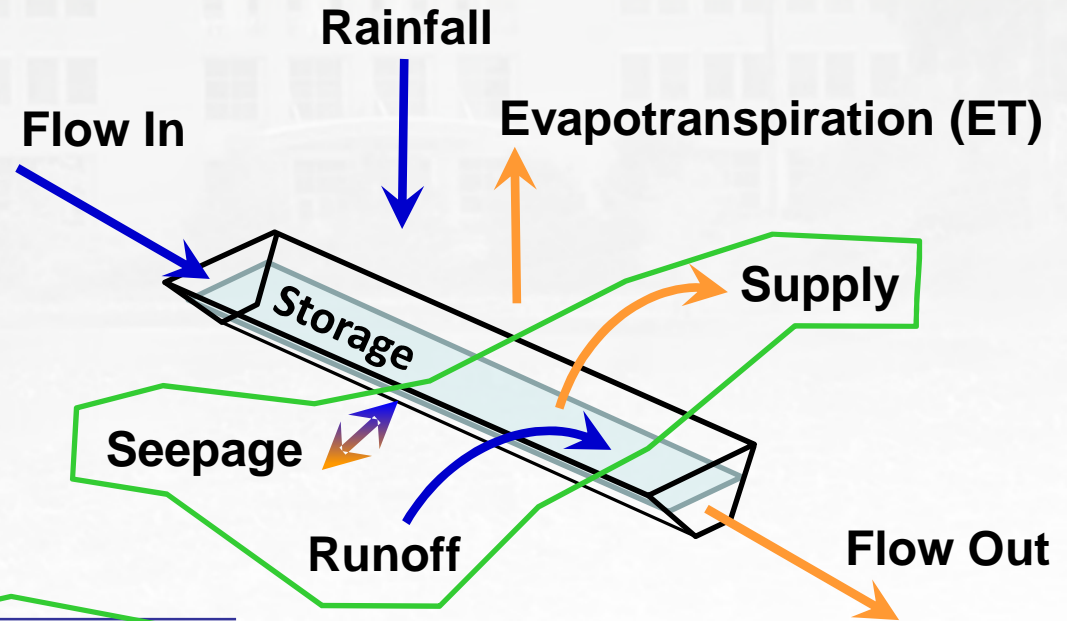
Canal Water Budget



$$\text{Change in Storage} = \text{Inputs} - \text{Outputs}$$

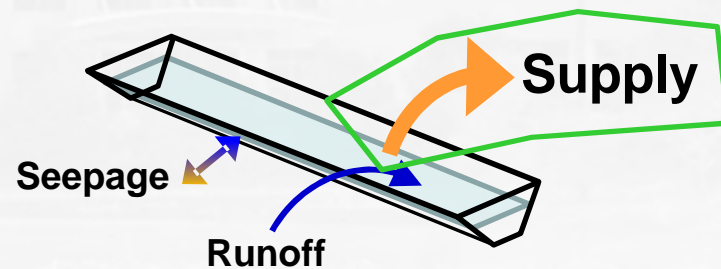
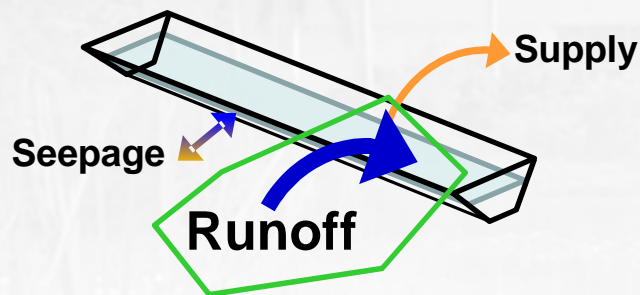
$$\text{Change in Storage} = \begin{matrix} \text{Rain} \\ \text{Flow In} \\ \text{Runoff} \\ \text{Seepage In} \end{matrix} - \begin{matrix} \text{ET} \\ \text{Flow Out} \\ \text{Supply} \\ \text{Seepage Out} \end{matrix}$$

Measured and Not Measured



Measured	=	Not Measured
Change in Storage		
Rain		
ET	=	Runoff
Flow In		Supply
Flow Out		Seepage

Net Runoff and Net Supply



Net Runoff	Net Supply
Runoff Supply Seepage = Positive	Runoff Supply Seepage = Negative

Example of Net Runoff

Net Runoff = (Runoff – Supply + Seepage) when positive

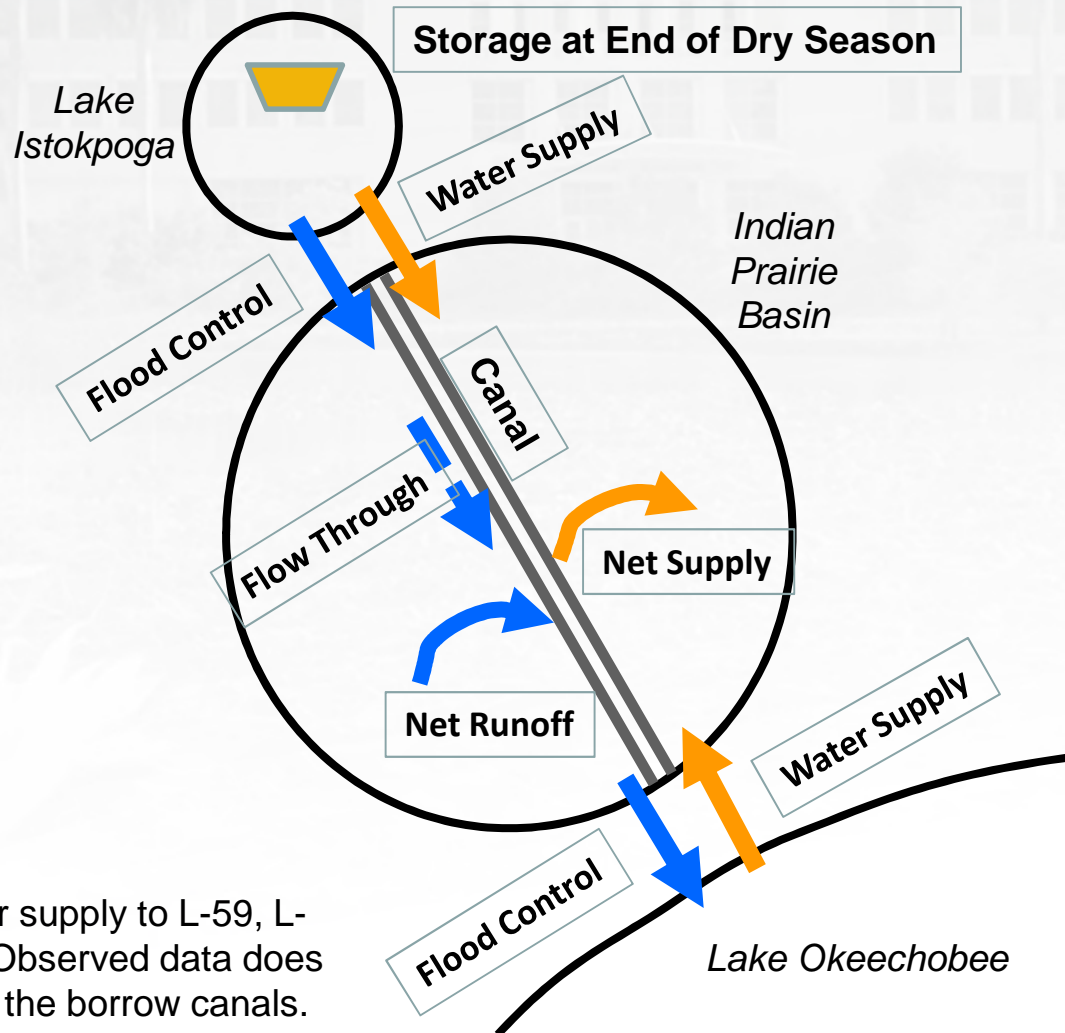
Date	Change in Storage	Rain	ET	Q _{in}	Q _{out}	Runoff - Supply + Seepage	Net Runoff	Net Supply
	ac-ft	inches	inches	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
02Jun2010	-1.6	0.80	0.18	1,162.4	1,329.6	117.5	117.5	0.0
03Jun2010	119.6	0.26	0.22	1,419.6	2,109.1	806.6	806.6	0.0
04Jun2010	-3.9	0.02	0.20	1,461.3	2,104.7	653.8	653.8	0.0
05Jun2010	70.0	1.33	0.19	479.1	1,527.3	1,029.2	1,029.2	0.0
06Jun2010	-138.4	0.11	0.24	643.2	2,480.0	1,708.9	1,708.9	0.0
07Jun2010	79.5	0.29	0.23	1,164.4	2,513.3	1,424.2	1,424.2	0.0
08Jun2010	-229.4	0.00	0.26	409.0	1,172.9	554.4	554.4	0.0
09Jun2010	107.5	0.00	0.24	0.0	542.7	668.9	668.9	0.0
10Jun2010	-23.6	0.00	0.27	0.0	277.1	274.5	274.5	0.0

Example of Net Supply

Net Supply = (Runoff – Supply + Seepage) when negative

Date	Change in Storage	Rain	ET	Q _{in}	Q _{out}	Runoff - Supply + Seepage	Net Runoff	Net Supply
	ac-ft	inches	inches	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
11May2010	19.9	0.0	0.26	153.6	0.0	-113.9	0.0	-113.9
12May2010	38.3	0.0	0.26	212.0	0.0	-153.7	0.0	-153.7
13May2010	-21.1	0.0	0.26	240.0	0.0	-241.3	0.0	-241.3
14May2010	-35.6	0.0	0.27	241.9	0.0	-256.3	0.0	-256.3
15May2010	67.0	0.0	0.25	318.3	0.0	-232.0	0.0	-232.0
16May2010	39.2	0.46	0.22	80.8	0.0	-60.7	0.0	-60.7

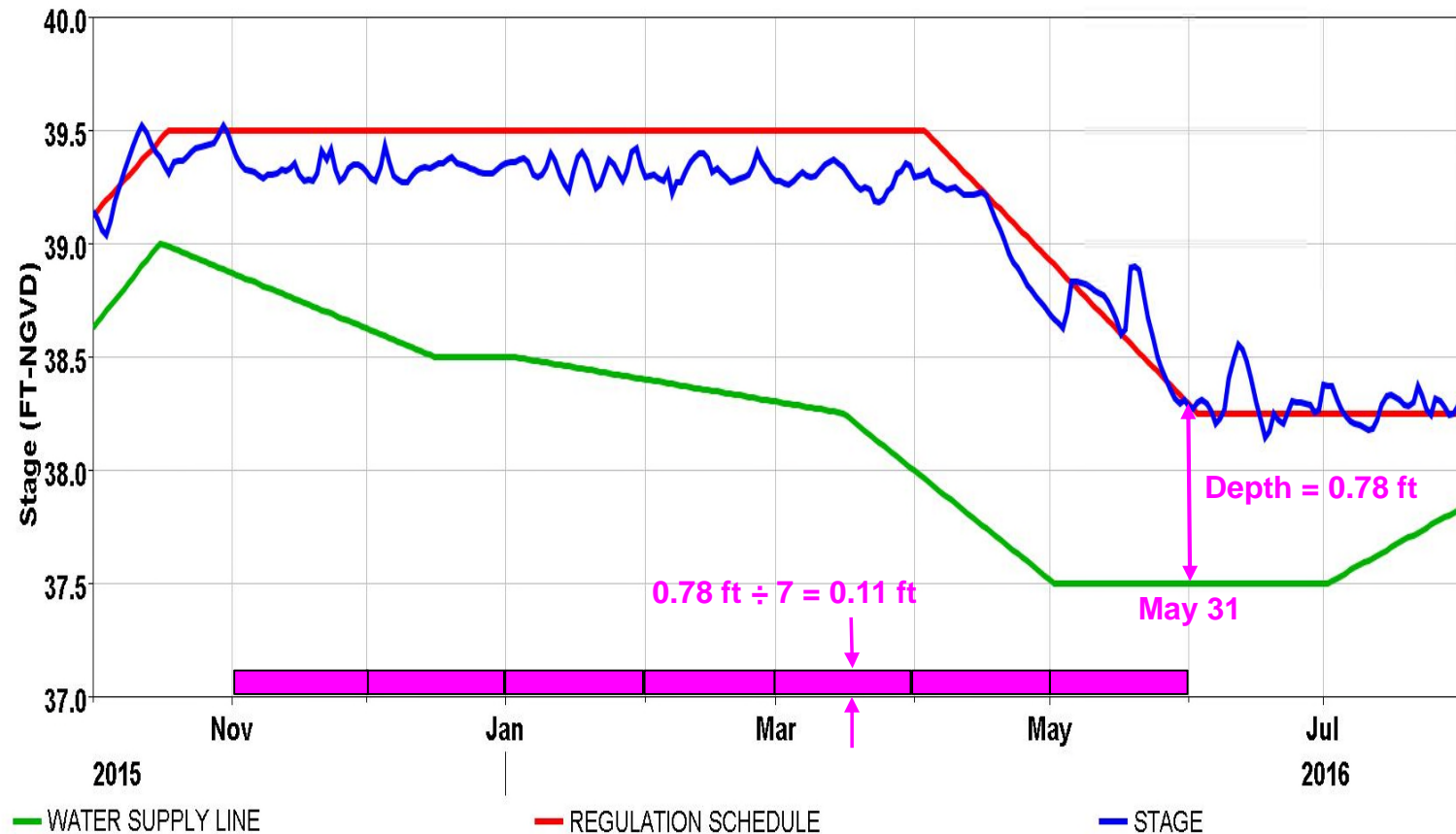
General Schematic: Indian Prairie Basin System

**Note:**

Observed data includes water supply to L-59, L-60, and L-61 borrow canals. Observed data does not include flood control from the borrow canals.

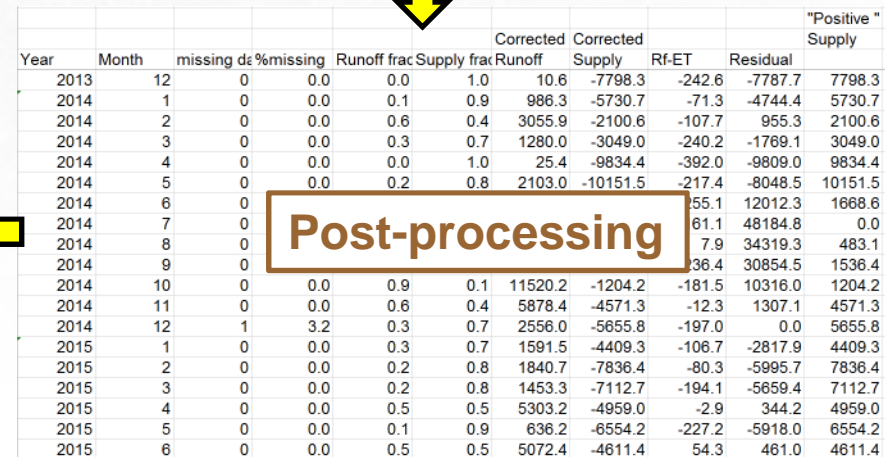
Determine Storage at End of Dry Season

Lake Istokpoga Stage Hydrograph 2015 -2016



Depth of 0.78 ft is equivalent to 22,100 ac-ft of water volume in the lake

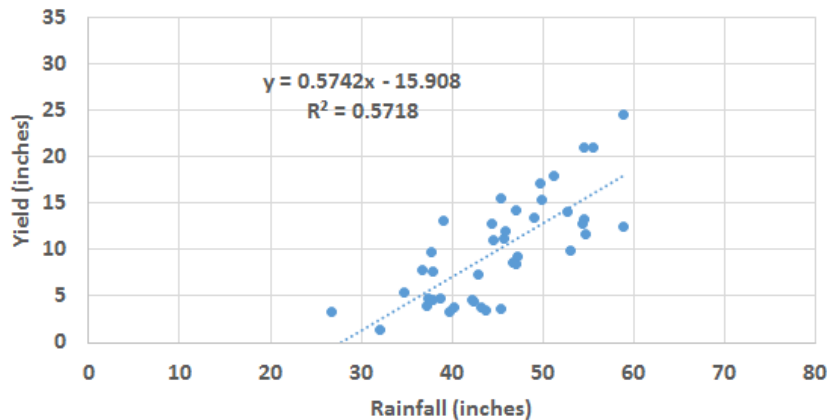
	Delta Q			rain-et			Residual
	ac-ft			in			ac-ft
17Sep2014	-309.5	-0.11	-0.04	-0.02	-0.05	-0.04	-305.5
18Sep2014	-293.6	-0.16	-0.15	-0.16	-0.15	-0.15	-281.3
19Sep2014	-199.9	1.04	1.18	1.15	1.11	1.02	-284.6
20Sep2014	1363.9	0.41	0.39	0.32	0.55	0.28	1335.1
21Sep2014	1741.2	0.10	-0.01	0.06	0.10	0.00	1738.0
22Sep2014	1799.7	0.50	1.38	0.84	0.77	0.63	1737.4
23Sep2014	3534.7	0.47	0.00	-0.01	0.15	0.07	3525.5
24Sep2014	3386.1	-0.11	-0.11	-0.02	0.03	-0.03	3389.2
25Sep2014	2046.6	0.88	0.86	1.17	0.61	0.90	1994.6
26Sep2014	3733.0	0.00	0.00	0.00	0.00	0.15	3703.7
27Sep2014	3778.2	0.02	0.02	0.02	0.02	-0.12	3788.3
28Sep2014	3176.1	0.01	0.01	0.01	0.01	0.08	3151.3
29Sep2014	2174.3	-0.13	-0.13	-0.03	-0.05	-0.07	2182.3
30Sep2014	1947.3	-0.08	-0.06	-0.03	-0.07	-0.07	1952.2
01Oct2014	1488.0	0.03	-0.03	-0.10	-0.11	-0.05	1491.9
02Oct2014	974.9	-0.14	-0.15	-0.15	-0.14	-0.14	986.4
03Oct2014	1213.2	0.27	0.19	0.31	0.60	0.16	1191.4
04Oct2014	1190.2	-0.03	-0.06	-0.03	0.05	-0.03	1192.3
05Oct2014	1199.3	-0.18	-0.18	-0.18	-0.18	-0.18	1213.4
06Oct2014	879.7	-0.13	-0.14	-0.13	-0.13	-0.13	890.0



Validation of the Water Budget Tool

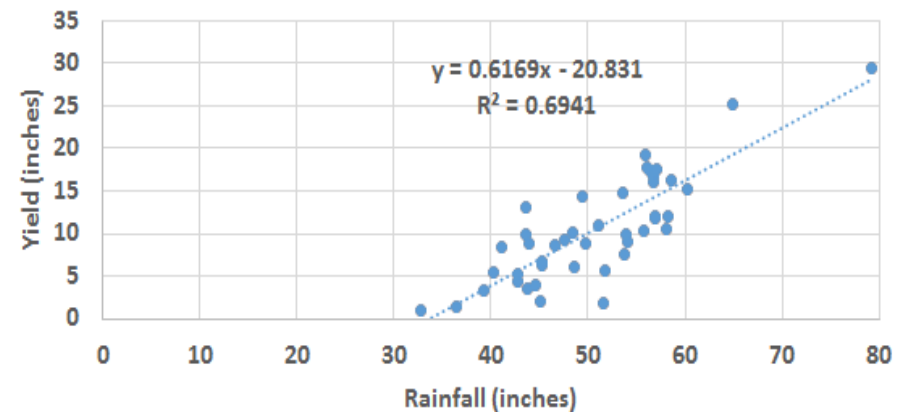
Rainfall-Yield Relationship

IPB Water Year Yield



- Indian Prairie Basin
- Rainfall-Yield relationship derived using WBT net runoff

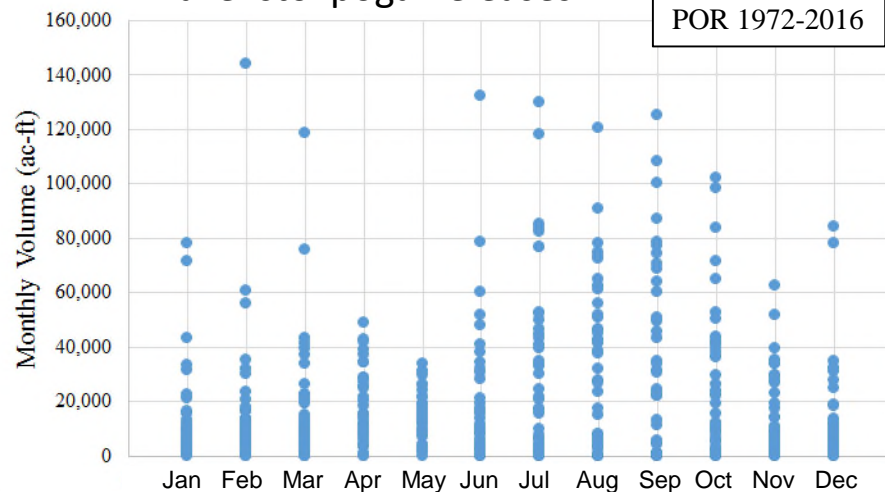
Fisheating Ck. Water Year Yield



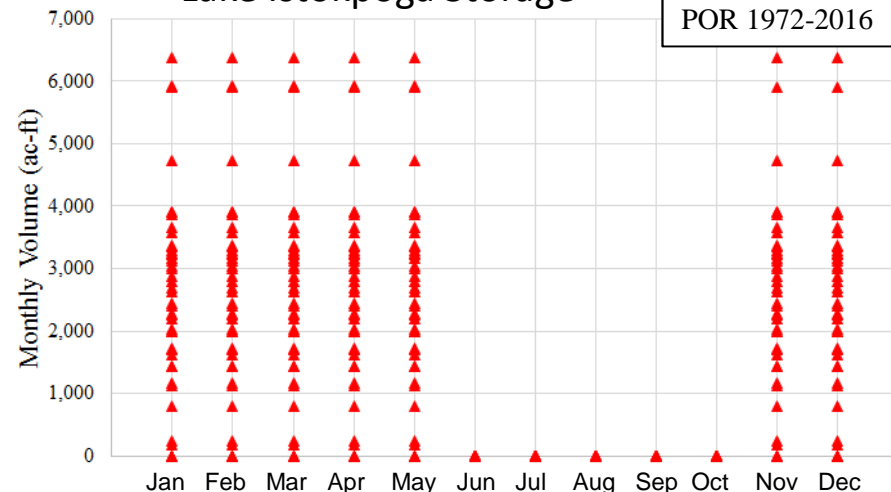
- Neighbor basin to IPB
- Rainfall-Yield relationship derived using USGS flows

Variability in Individual Water Budget Components

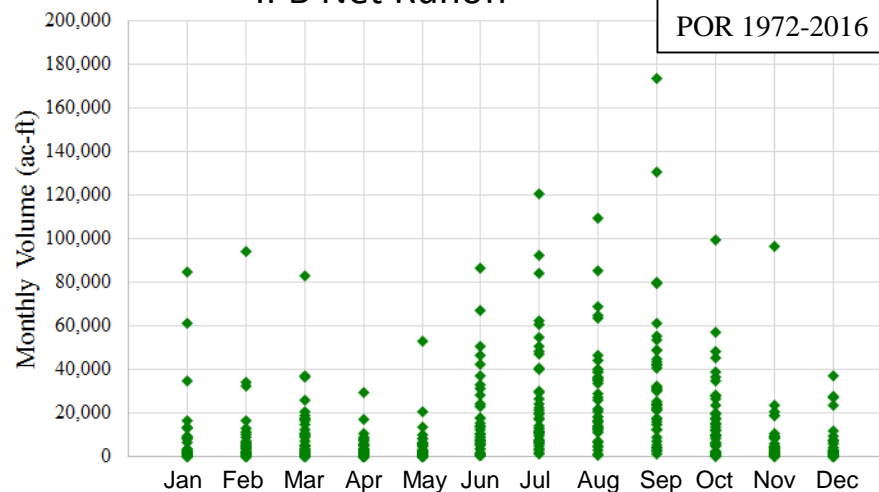
Lake Istokpoga Releases



Lake Istokpoga Storage

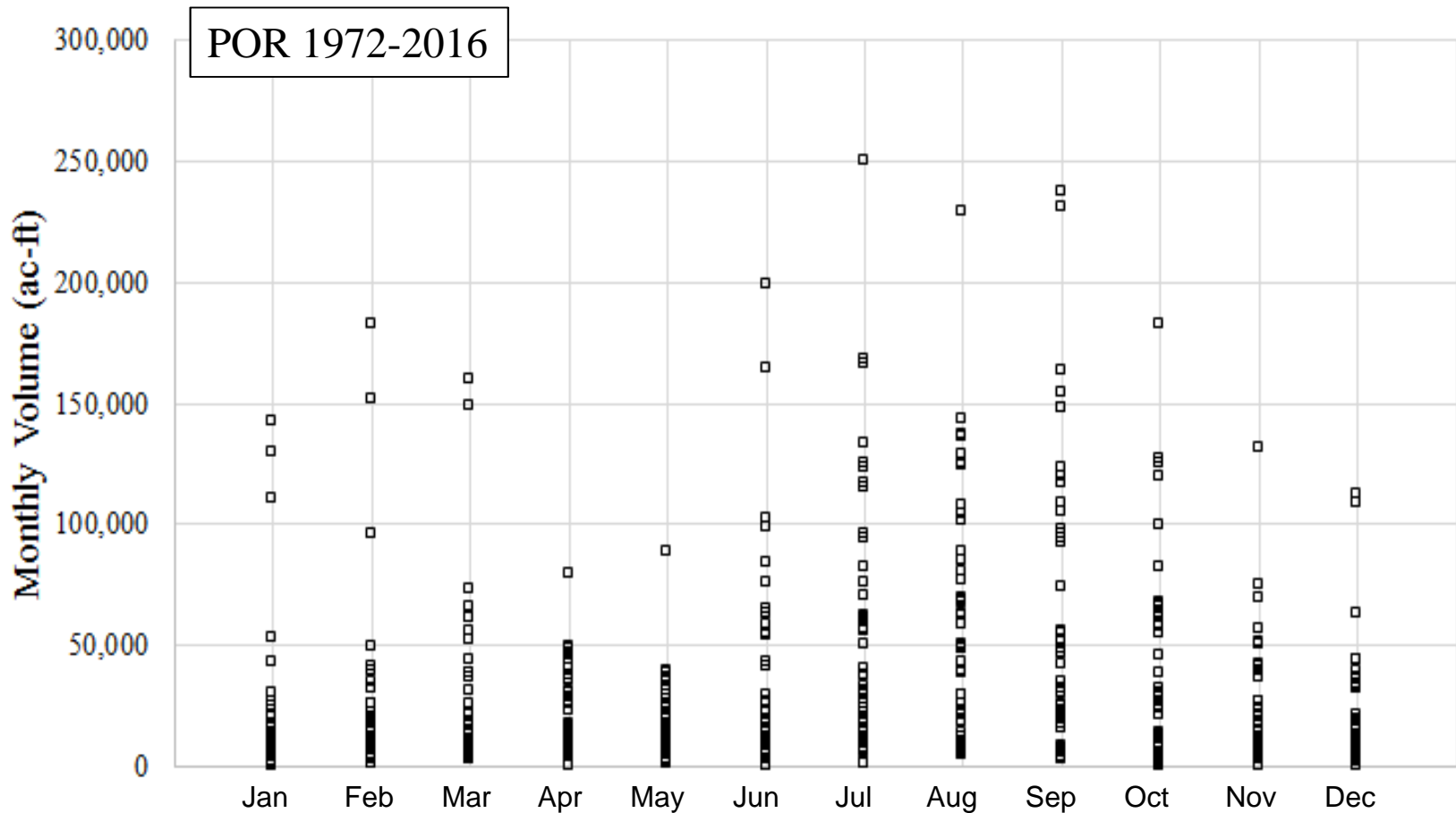


IPB Net Runoff

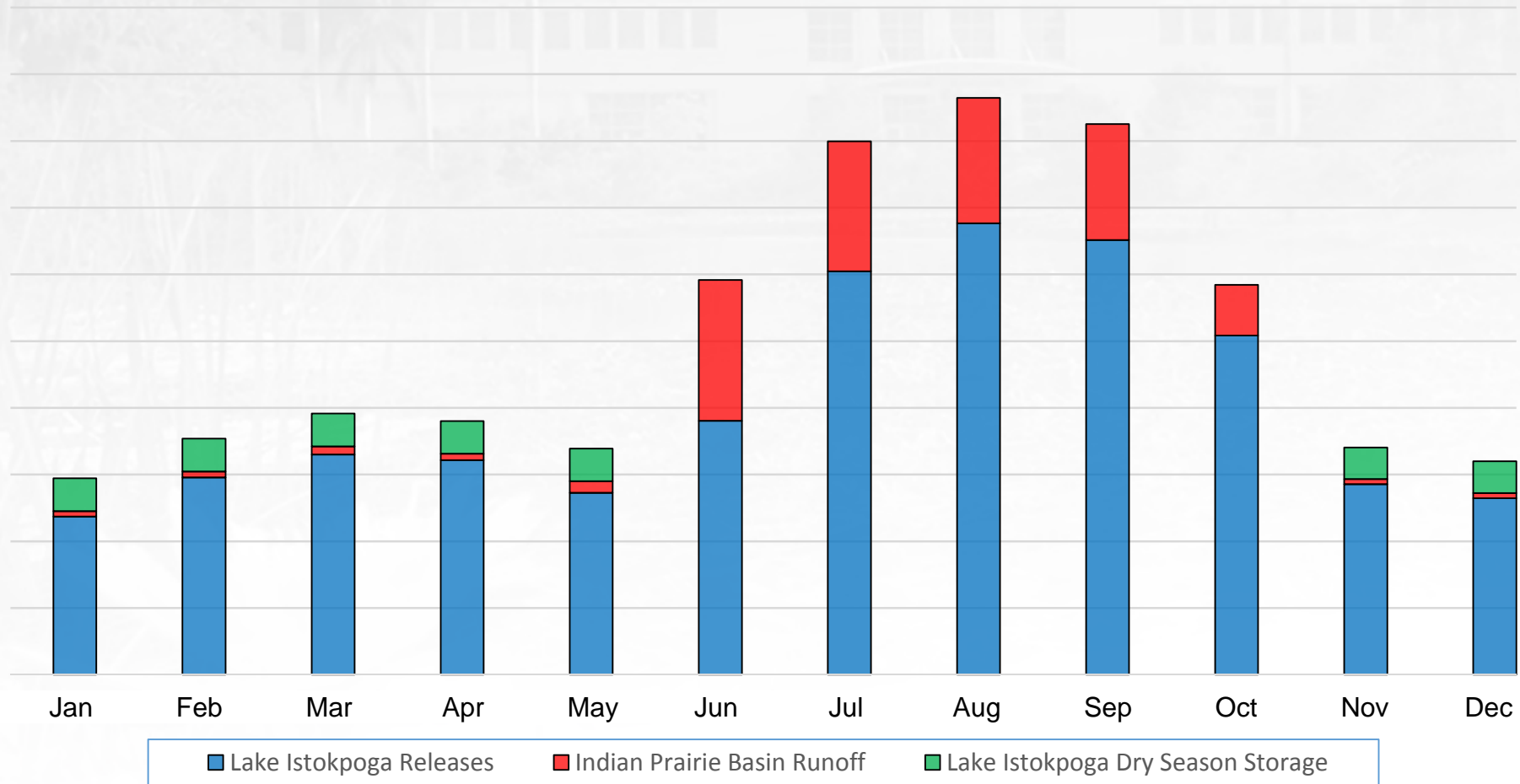


Variability in Combined Water Budget Components

Lake Istokpoga Releases + Lake Istokpoga Storage + IPB Net Runoff



Relative Volumes of Water Budget Components



Characteristics of 2016 Surface Water Quantification

Water Budget Component	Characteristics
Lake Istokpoga Releases	<ul style="list-style-type: none">• S68 flow data 1972 to 2016• S68X flow data 2009 to 2016
Indian Prairie Basin Runoff	<ul style="list-style-type: none">• Five watersheds• Water budget data 1972 to 2016• Reflects changes in land use over time
Lake Istokpoga Storage	<ul style="list-style-type: none">• Stage data 1972 to 2016• Regulation schedules of 1974 and 1990• Water supply line changed over time, 36.0 to 37.5 ft

Differences Between 2016 Quantification and 1988 Report

Water Budget Component	Characteristics		Type of Difference
	2016	1988	
Lake Istokpoga Releases	<ul style="list-style-type: none"> • S68 flow data 1972 to 2016 • S68X flow data 2009 to 2016 	<ul style="list-style-type: none"> • S68 flow data 1964 to 1987 	Data
Indian Prairie Basin Runoff	<ul style="list-style-type: none"> • Five watersheds • Water budget data 1972 to 2016 • Reflects changes in land use over time 	<ul style="list-style-type: none"> • Four watersheds, excluded C-41AS • Rainfall-runoff calibrated 1976 to 1980, verified 1972 to 1975, simulated 1925 to 1987 • Land use 1977 	Data and Procedure
Lake Istokpoga Storage	<ul style="list-style-type: none"> • Stage data 1972 to 2016 • Regulation schedules of 1974 and 1990 • Water supply line changed over time, 36.0 to 37.5 ft 	<ul style="list-style-type: none"> • Stage data 1972 to 1987 • Regulation schedule of 1974 • Water supply line 37.25 ft 	Data

Next Steps

- **Finalize the tool and related documentation**
- **Subject to independent peer review**
- **Provide detailed information on the tool to interested stakeholders**
- **Apply the tool to the quantification of available surface water within the Indian Prairie Basin with Seminole Tribe of Florida and public engagement.**

Questions?

Total Surface Water Available

